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THE ELEMENTAL CHARACTER OF SENSORY DISCRIMINATION

BY

Carl E. Seashore and Kwei Tan

The problem here reported grew out of that of the preceding article by Seashore and Ling in which it was demonstrated that the blind, though so largely guided by the sense of hearing and touch in their daily activities, are not superior to seeing persons in elemental tests of fundamental capacities in these senses. In that investigation an elemental test was defined as one in which the "measurements were so simple and natural that training, experience, and special skill would not affect the results." This fact of the equality of the blind and the seeing was regarded as proof of the elemental character of the test.

To gather proof from another angle it was decided to take one of these tests, namely, discrimination for the intensity of sound, and submit a number of observers to prolonged practice for the purpose of determining whether or not ability in this test improved with practice. The procedure was exactly the same as reported in the preceding article. The audiometer was used with the 100 v.d. fork, the current being kept at 1.2 volts. The mercury was kept clean, and the physical conditions and the control of the instrument were satisfactory throughout. A single increment was employed for the whole series, namely, the step from 38 to 39, on the audiometer, and the test consisted of one hundred trials for each day under conditions as nearly constant as possible, both subjective and objective. The record was kept in terms of the number of right cases. The observers, designated by letter in the following table, were all students in Psychology who had had some experience in experimental work but no training in this particular test.

In a few cases two or even three hundred trials were taken during the same day, but the general effort was to get one set of observations a week. The experiments were conducted in the light-sound-and-jar-proof room in the psychological laboratory with both observer and experimenter present in the room. The room was ventilated freely every twenty minutes

Records of these trials are shown in Table 1, in which the numbers given are the number of right decisions in each one hundred trials for each of the chosen observers. The average and median are given only for thirteen periods. It is evident that it would not be fair to continue the average beyond that point for the reason that each observer represented a different degree of ability and the dropping out of, *e.g.*, D. and H. W. at the end of the thirteenth day would distort the average record seriously.

The fluctuation in these figures may appear at first as being rather large, but when one considers that the record is in terms of right and wrong cases, there is really a very satisfactory uniformity on the whole.

Records of introspections and objective observations were kept faithfully, but as these are of an ordinary nature it is hardly worth space to detail them here. Suffice it to say that the variations in the per cent. of right cases is not greater than one would ordinarily find in a single one hundred trials on successive days under very favorable circumstances in any type of discrimination.

TABLE I—*The effect of practice on discrimination for the intensity of sound*

	A.	F.	H.	T.	G.W.	N.W.	C.	D.	Go.	Gr.	H.W.	*Median*	*Ave.*
1.	88	91	94	89	86	65	88	76	86	95	74	88.1	84.7
2.	90	92	92	89	88	64	95	75	88	94	65	89.0	84.7
3.	94	97	92	83	91	69	89	78	90	90	77	89.7	86.3
4.	93	95	80	78	91	87	97	86	80	93	79	87.3	87.1
5.	92	78	76	68	91	89	95	83	89	92	76	88.0	84.4
6.	91	80	73	72	87	89	90	68	94	88	82	86.5	83.0
7.	94	99	75	89	79	87	98	69	89	98	89	90.8	87.8
8.	92	99	90	94	88	91	95	82	94	96	76	91.5	90.6
9.	92	88	93	92	83	89	99	78	89	93	63	90.0	87.1
10.	88	90	95	95	94	85	88	82	82	86	69	87.0	86.7
11.	86	94	91	93	98	75	97	81	83	76	71	84.5	85.9
12.	87	91	78	85	100	79	90	82	87	91	61	86.0	84.6
13.	95	91	89	82	95	79	91	84	85	85	59	86.4	85.0
14.	87	96	84	93	95	90	89		93				
15.	89	96	99	85	94	75	90		80				
16.	88	96	94	96	91	84	90						
17.	90	93	96	95	85	90	93						
18.	83	86	94	91	94	86							
19.	95	96	97	94	96	93							
20.	84	96	96	67	92	90							

Looking then at the average and the median, we see that these run practically constant for the thirteen days. Beyond the thirteenth day each observer's record must be judged by itself, and it will be found that in these there is no marked tendency toward raising or lowering the general average for a given observer. We must, therefore, arrive at the conclusion that, for periods of training represented by this series, there is in this test no marked evidence of improvement with practice. For a single observer one hundred trials are inadequate, by the present method, but by taking a larger number of observers under similar conditions and by treating the results together in the average and the median, we compensate in part for this shortcoming.

Some of the fluctuations must, however, be accounted for by recognizing a certain degree of complexity in the problem. For example, various observers reported from time to time that they observed, or were trying, accessory aids in judging; for example, the sound was visualized and the judgment was made in terms of distance, the fainter sound being farther away. Or the difference was imaged in terms of motor tendencies, the lower sound calling forth, in one type, less effort because it was easy to hear and, in another type, the larger effort as a matter of counteraction. On the whole the introspections do not reveal any case in which the adoption of a particular method seems to have changed capacity permanently from the point of adoption.

Furthermore, the situation was not entirely free from objective disturbances. The observations being taken in the sound-light-and-jar-proof room, exceedingly faint accessory stimuli did prove disturbing. In an earlier experiment of this kind, one observer said that he could hear his backbone creak under these circumstances. This was probably not true, but it illustrates the tendency to be affected by obscure stimuli. There are, of course, momentary disturbances of itching, pain, or pressure, due to the holding of the receiver to the ear. Together with this there is also the subjective factor, the change in disposition, physiological tone, aggressiveness, etc. from day to day.

Bearing in mind that this test was selected as a sample from among six other tests which were supposed to be elemental, it is reasonable to conclude, in the absence of evidence to the contrary, that the same elemental character could be established for the other tests reported in the foregoing article.

The only one of these on which there is any considerable amount of reliable literature available is that of lifted weights. This test has, perhaps, been studied with more exactness than any other test in the psycho-physical literature. Extraordinary refinements have been made in the discovery of the conditions for change in the capacity. Most of these are in the nature of the laws of illusions. But, as we look back upon literature as a whole, we find that ordinarily a careful observer does not improve with training. He may and usually does go through a cycle of changes which may be traced to the operation of certain motives for illusion. The same would probably be observed in any psycho-physical test that can be subjected to sufficiently rigorous study.

We have, then, in this and the preceding article evidence of the elemental character of the tests from two points of view, namely, that of highly specialized sense training in actual life, in the blind, and that of accurately controlled measurement of training in a comparatively short series.

There is a third line of evidence that must be sought. In fact, these experiments were suggested by the discovery that in pitch discrimination the actual native capacity in sensory discrimination for pitch does not develop with age. Whether that rule applies to these six tests should be worked out with great care upon a series of ages of children from, say eight to sixteen. On all the tests, we have records of children showing clearly that there is improvement in the record, which we may call the "gross record" or "total output", from year to year up to about fifteen. But the challenge set up by this experiment is to repeat those experiments and analyze them to find out to what extent this improvement with age consists in overcoming the difficulties which are due to the incomplete mastery of the test by the observers. In other words, we may lay down this as an hypothesis for further experiment: In psycho-physic tests of sensitivity or discrimination the conditions must be so simple and so accurately under control that they are equally fair to the skilled and the unskilled, the trained and the untrained, the young and the old. Only then shall we measure sensory discrimination in its true capacity.

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